WO 9001600
FEB 1990

PCT

INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 4 : E04C 5/16 — A1

(11) International Publication Number: WO 90/01600

(43) International Publication Date: 22 February 1990 (22.02.90)

(21) International Application Number: PCT/US89/03456

(22) International Filing Date: 11 August 1989 (11.08.89)

(30) Priority data:
232,313 15 August 1988 (15.08.88) US

(71) Applicant: DKC MANUFACTURING, INC. [US/US]; 505 Evening Star Lane, Newport Beach, CA 92660 (US).

(72) Inventor: WIRGES, Christopher ; 32 Oak Tree Lane, Irvine, CA 92665 (US).

(74) Agents: STETINA, Kit, M. et al.; Stetina and Brunda, 24221 Calle de la Louisa, Ste. 401, Laguna Hills, CA 92653 (US).

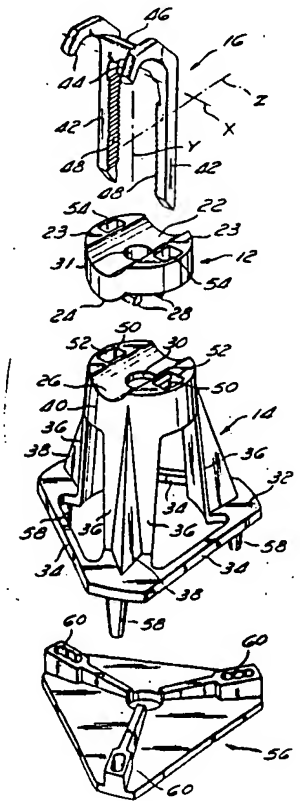
(81) Designated States: AT (European patent), AU, BE (European patent), CH (European patent), DE (European patent), FR (European patent), GB (European patent), IT (European patent), JP, KR, LU (European patent), NL (European patent), SE (European patent).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: CONSTRUCTION SPACER AND METHOD OF USE

(57) Abstract

A construction spacer (10) and method for its use. The construction spacer (10) includes a support element (14); a removable, preferably saddle-shaped, spacing element (12) positionable upon an upper surface of the support element (14), including a means for securely supporting the spacing element on the upper surface; and, a unitary clamp member (16) capable of securing an elongated upper construction member (20) along a first axis and a lower construction member (18) along a second axis substantially perpendicular to the first axis. The clamp member (12) has a pair of extending leg members (42) at one end thereof. Each leg member (42) is securable within contiguous slots (52, 54) formed within the support element (14) and the spacing element (12) and in a plane substantially perpendicular to the first and second axes. The leg members (42) are sufficiently spaced apart to allow the lower construction member (18) to be received therebetween along the second axis. The clamp member (16) terminates at a second end (44) which is hooked for receiving the upper construction member (20).



CONSTRUCTION SPACER AND METHOD OF USE

Background of the Invention

1. Field of the Invention

The present invention relates to spacers for use in supporting elongated construction members and more particularly to construction spacers used for supporting elongated reinforcing members formed in reinforced concrete and methods of using these construction spacers.

2. Description of the Related Art

With construction involving reinforced concrete, such as for floors and walls in buildings and for highways, spacers are required for supporting and maintaining elongated reenforcing members which are positioned in the space where the concrete is to be poured. These reinforcing members may be rods or bars, commonly referred to as "rebar" or may, for example, comprise flexible cables. After the lattice-work of typically perpendicular and parallel reinforcing members is prepared and properly positioned, the concrete is poured over this framework, embedding the construction spacers and reinforcing members within the interior of the concrete pour.

In addition to supporting reinforcing members these construction spacers are utilized for other construction applications in varying degrees, such as for captively retaining water and gas tubing in desired positions, as well as wire cabling or harnesses.

In most applications utilizing these construction spacers, the vertical height of the construction member being positioned is of utmost importance. This dependency on vertical height is even more apparent given modern construction techniques. For example, in the past, rebar has been typically embedded in the concrete pour in a parallel

spaced manner with perpendicular cross rebar forming lattice-work. In modern post tensioning poured concrete applications the parallel and/or perpendicular rebar is very often substituted with flexible cables which extend in generally sinusoidal patterns within the concrete pour. Thus there is a heightened need for a versatile construction spacer which can easily adjust to different vertical heights.

In addition to the actual need to correctly adjust to different vertical heights, there is a commensurate need for a viewer to be able to easily discern that, in fact, the correct positioning has been achieved. Reinforcement is mandated in varying degrees by building codes which are generally becoming more stringent. The lattice-work is usually inspected prior to the pour of concrete to determine whether the proper configuration is being used. The sinusoidal patterns presently being used are difficult to assess by visual-inspection.

The prior art has generally failed to address the aforementioned difficulties involved in modern construction techniques. For example, U.S. Patent No. 4,655,023 entitled "Spacer for Construction Use", issued to F.P. Yung, discloses a spacer comprising a support post section having an uppermost portion including a saddle-shaped upper surface. The saddle-shaped upper surface has a pair of aligned, generally parallel, axially extending openings having inwardly disposed tangs. The tangs are adapted for frictionally engaging the barbed ends of a generally U-shaped retainer member which is configured for retaining the rebar within the saddle by inserting the barbed ends within the openings after positioning the rebar thereon. In one embodiment the bight portion of the retainer member has a transversely extending member integrally formed therewith which additionally includes a saddle portion at the midpoint thereof for facilitating retention of a second rebar; the two rebars being stacked in

a perpendicular relationship. Thus, while addressing the possibility of utilizing an "integrally" formed retainer member for positioning two orthogonal rebars, the retaining member disclosed in the Yung reference is awkward in shape and difficult to manufacture. This is undesirable, especially in view of the fact that, for the most part, each construction spacer will only be used once.

Furthermore, the Yung device, like the other prior art, does not address the need for easily adjusting the vertical height of the spacers. Generally, what is presently required are devices of various sizes which must be carried out to the construction site and utilized when deemed appropriate.

Objects and Summary of the Invention

A principal object of the present invention, therefore, is to provide stable and accurate positioning of construction members in construction applications.

It is another object to provide an improved construction spacer which is particularly adapted for use with elongated reinforcing members used in reinforced concrete.

It is another object to provide a construction spacer which can easily be adapted to various vertical heights.

Still another object is to provide a construction spacer with a minimal number of parts and which is easy to manufacture.

Yet another object is to provide an efficient, easy method of forming high-strength reinforced concrete having a desired geometric pattern of elongated reinforcing members.

These objects are achieved by the present invention which comprises a construction spacer and a method for its use. In its broadest aspects, the present invention includes providing a support element supported by the supporting construction surface; a removable spacing element positionable upon an upper surface of the support element, including means for

securely supporting the spacing element on the upper surface; and, a unitary clamp member capable of securing an upper construction member along a first axis and a lower construction member along a second axis substantially perpendicular to the first axis. The clamp member has a pair of extending leg members at one end thereof. Each leg member is securable within contiguous slots formed within the support element and the spacing element and in a plane substantially perpendicular to the first and second axis. The leg members are sufficiently spaced apart to allow the lower construction member to be received therebetween along the second axis. The clamp member terminates at a second end which is contoured for receiving the upper construction member.

Inasmuch as the subject invention utilizes a minimal number of easily fabricatable parts, it is particularly useful as a spacer for elongated reinforcing members used in reinforced concrete. Use of the removable spacing element permits utilization of spacing elements of varying vertical heights with the same support element, thus greatly aiding workers at the construction site. Furthermore, the spacing elements may be color coded for easily determining whether the desired geometric pattern, for example a sinusoidal configuration, has been achieved. In the preferred embodiment, the spacing element has a saddle-shape so that the upper surface thereon is receptive to a construction member and so that the lower surface thereon cooperatively mates with a complimentary saddle surface on the top of the support element.

The clamp member is also easily removable. In the preferred embodiment, each leg member has a toothed surface which frictionally engages a similarly formed surface at the adjacent edge of the slot in the support element.

Other objects, advantages and novel features of the present invention will become apparent from the following

detailed description of the invention when considered in conjunction with the accompanying drawings.

Brief Description of the Drawings

Figure 1 is a perspective view of an assembled construction spacer of the present invention in relation with the users fingers, illustrating retained perpendicularly stacked elongated construction members;

Figure 2 is an exploded perspective view of the present invention, shown with a sandplate;

Figure 3 is a perspective view of a spacing element with a vertical height greater than the spacing element illustrated in Figure 2;

Figure 4 is a schematic side elevational view of a plurality of construction spacers in interconnected relation, illustrating the method in which a sinusoidal pattern can be achieved by utilizing spacing elements having different vertical heights; and

Figure 5 is a second embodiment of the construction spacer of the present invention.

The same elements or parts throughout the figures of the drawing are designated by the same reference characters, while equivalent elements bear a prime designation.

Detailed Description of the Preferred Embodiment

Referring to the drawings and the characters of reference marked thereon, a first embodiment of the construction spacer of the present invention is generally designated as 10 in Figure 1. The construction spacer 10 includes a saddle or spacing element 12 positioned on top of a support element 14. A dual pronged clamp member 16 securely engages the spacing element 12 and support element 14 and anchors two rebars 18, 20 in mutually perpendicular stacked relation.

This construction spacer 10 is particularly adapted for use with elongated reinforcing members, i.e. rebar, used in reinforced concrete. For this reason the invention will be described in connection with this particular use. In view of the above-noted broader utility of the invention, it will be understood that this described application involving reinforced concrete is purely illustrative and not limiting in nature.

Referring now to Figure 2, the individual components of the present invention can be seen in greater detail. The saddle element 12 has a generally inverted saddle-shape with a circular cross section. An upper saddle surface thereon has a concave central section 22 for supporting a rebar, and two substantially flat surfaces 23 on each side thereof. A lower saddle surface has a convex central section 24 for complimentary engagement with an upper saddle surface 26 on the support element 14. A pair of biasing tabs 28 extend from the convex section 24 and are captively received through a central aperture 30 on the top of the support element 14. (The biasing tabs 28 can be seen in greater detail in Figure 3.) A central aperture 31 is also formed within the spacing element 12 for improved plastic management, cost savings, and for achieving better flexure of the biasing tabs 28.

The support element 14 includes a base plate 32 having a cutout center (for weight savings) and sides 34 formed as an equilateral triangle. Extending upwardly from each apex of the base plate 32 are integral support posts 36 having centrally disposed tapered portions 38 with triangular cross sections for maximum support. As noted, the top portion 40 of the support element 14 has a saddle surface 26 with a central aperture 30 for receiving the biasing tabs 28 which extend within the interior and slightly beneath the lower edge thereof.

The unitary formed clamp member 16 includes two straight, internally toothed leg members 42 (extending parallel to an axis designated Y) which are sufficiently spaced to receive the lower rebar 18 therebetween which extends parallel to a perpendicular axis designated Z. Each leg member 42 terminates at its upper end with a contoured section, i.e. a claw or hook 44. The spaced hooks 44 cooperate to receive the upper rebar 20 extending parallel to another axis designated X which is perpendicular to axes Y, Z. The legs 42 and claws 44 on each side of the clamp member 16 are connected by connecting portion 46 thereby forming a unitary means for clamping the two perpendicularly stacked rebars 18, 20. The internal surface of each leg member 42 has teeth 48 that are adapted for frictionally engaging a corresponding serrated surface 50 on the edge of slot 52 formed through the top of the support element 14.

Thus, during assembly, the clamp member 16 is positioned to retain the lower rebar 18 between leg members 42 and the upper rebar 20 within the hooks 44. The leg members 42 are inserted through slots 54 in the spacing element 12 and then through the slots 52 in the support element 14. The complimentary fit existing between concave surface 26 and convex surface 24 serves to prevent relative rotation between the support element 14 and spacing element 12. Each tooth 48 on each leg member 42 preferably has a horizontal upper surface (detail not illustrated) which mates with a corresponding horizontal lower surface on each tooth of the serrated surface 50 on the support element 14. Thus, the clamp member 16 is unidirectionally latched, i.e. it may be pushed down into slots 52 of the support element 14 but cannot be lifted upwardly therefrom.

A sandplate 56 is provided which may be secured to pegs 58 on the bottom of the support element 14. The sandplate 56 supports the construction spacer 10 on a prepared sand

surface, preventing it from becoming partially buried. Spaced sockets 60 accommodate varying sized construction spacers 10, for example, two inch, three inch and four inch spacers.

Referring now to Figure 3, a spacing element 12' is shown having a vertical height greater than that of the spacing element 12 of the previous figures. However, the cross-sectional area and shapes of the upper and lower surfaces of the spacing element 12' have remained the same, thereby allowing the spacing element 12' to be utilized with the previously illustrated support element 14 and clamp member 16. Use of these interchangeable spacing elements provides heretofore unrecognized and unavailable flexibility for construction techniques. Furthermore, the variously sized spacing elements may be color coded for easily identifying the correct size prior to it being fitted in the lattice-work or after being emplaced as a check that the desired configuration has been achieved.

The benefit of using the construction spacer of the present invention is highlighted when described with reference to modern post-tensioning poured concrete applications. Referring now to Figure 4, in such modern applications one or both of the rebars 18, 20 are substituted with a flexible cable 62 which extends in a generally sinusoidal pattern through a lattice-work of construction spacers 10, 10' having varying desired heights. After pouring and curing of the concrete, opposite ends of the cable 62 are placed in tension (designated by arrows 64), i.e. approximately 30,000 pounds/square inch of tension, which significantly increases the resultant strength of the concrete pour. Use of the presently described construction spacers 10, 10' insures that the proper sinusoidal shape of the cable 62 is maintained throughout this process. Use of spacing elements which are color coded allows the construction worker and/or inspector, who has looked at a formation prior to the pour of concrete,

to rapidly visually determine whether or not the proper sinusoidal configuration of the cable 62 is maintained on the supporting surface 66. Preferably the spacing elements are formed having one-quarter inch height increments, each increment having a different color.

Referring to Figure 5, there is shown a second embodiment 10A of the construction spacer of the present invention. As will be recognized, in this second embodiment, the support element 14A is formed having the same configuration to the support element 14 depicted in Figures 1-4 except that the lower perimeter base portion 34 and legs 58 have been removed. In addition, to provide increased structural rigidity, an annular member or ring 70 is positioned within the interior of the posts 36A, preferably intermediate along their length. Preferably, the annular member 70 is formed integral with the support element 14A, but alternatively the same may be formed as a separate member which is subsequently affixed to the interior of the support post 14A by way of adhesive and/or heat fusion.

In its operative application, the support element 14A may be utilized in conjunction with the spacer element 12 and/or 12' and retainer member 16 in a manner previously described. Additionally, a sandplate (not shown) formed in an analogous configuration to the sandplate 56 depicted in Figure 2 may be utilized with the plural apertures 60 being formed in a complementary configuration to the triangular cross-section of the support post 36A of the support element 14A.

Obviously, many modifications and variations of the present invention are possible in light of the above teachings. It is therefore to be understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

WHAT IS CLAIMED IS:

What is claimed and desired to be secured by Letters Patent is:

1. A construction spacer for supporting elongated construction members used in construction applications relative to a supporting surface, comprising:

(a) a support element positionable on said supporting surface for providing stable support of a portion of at least one reinforcing member;

(b) a removable spacing element positionable upon an upper surface of said support element, including means for securely supporting said spacing element on said upper surface; and

(c) a unitary removable clamp member capable of securing an upper construction member along a first axis and a lower construction member along a second axis substantially perpendicular to said first axis, said clamp member having a pair of extending leg members at one end thereof, each leg member securable within contiguous slots formed within said support element and said spacing element and in a plane substantially perpendicular to said first and second axes, said leg members being sufficiently spaced apart to allow said lower construction member to be received therebetween along said second axis, said clamp member terminating at a second end which is hooked for receiving said upper construction member along said first axis.

2. The construction spacer of Claim 1 wherein said spacing element includes an upper surface with a saddle-shape including a concave central section for supporting said lower construction member, and two substantially flat surfaces on each side thereof having said slots formed therethrough.

3. The construction spacer of Claim 1 wherein said means for securely supporting said spacing element on the upper surface of said support element includes a pair of

biasing tabs which extend from a lower surface of said spacing element and through a central aperture formed in the upper surface of said support element.

4. The construction spacer of Claim 1 wherein:

said spacing element has a lower surface with a saddle-shape including a convex central section and two substantially flat surfaces on each side thereof, and

the upper surface of said support element has a saddle-shape including a concave central section and two substantially flat surfaces on each side thereof providing a complimentary fit with the lower surface of said spacing element which serves to prevent relative rotation between the support element and the spacing element.

5. The construction spacer of Claim 1 wherein each leg member of said clamp member has a serrated surface for providing a friction fit when engaged with a corresponding serrated surface on an edge of the respective slot formed within said support element.

6. The construction spacer of Claim 1 wherein the second end of said clamp member includes a pair of spaced-apart hooks.

7. The construction spacer of Claim 1 wherein said support element includes:

a base plate having sides formed as an equilateral triangle;

posts extending upwardly from the apexes of the base plate; and

a centrally disposed top portion connected to the upper ends of said posts having said upper surface for supporting said spacing element.

8. The construction spacer of Claim 1 wherein said removable spacing element is color-coded according to its vertical height.

9. A construction spacer for supporting elongated reinforcing members used in reinforced concrete, comprising:

(a) a support element for providing stable support of a portion of at least one reinforcing member relative to a supporting surface;

(b) a removable spacing element positionable upon an upper surface of said support element, including means for securely supporting said spacing element on said upper surface; and

(c) a unitary removable clamp member capable of securing an upper reinforcing member along a first axis and a lower reinforcing member along a second axis substantially perpendicular to said first axis, said clamp member having a pair of extending leg members at one end thereof, each leg member securable within contiguous slots formed within said support element and said spacing element and in a plane substantially perpendicular to said first and second axes, said leg members being sufficiently spaced apart to allow said lower reinforcing member to be received therebetween along said second axis, said clamp member terminating at a second end which is hooked for receiving said upper reinforcing member along said first axis.

10. The construction spacer of Claim 9 wherein said spacing element includes an upper surface with a saddle shape including a concave central section for supporting said lower reenforcing member, and two substantially flat surfaces on each side thereof having said slots formed therethrough.

11. The construction spacer of Claim 9 wherein said means for securely supporting said spacing element on the upper surface of said support element includes a pair of biasing tabs which extend from a lower surface said spacing element and through a central aperture formed in the upper surface of said support element.

12. The construction spacer of Claim 9 wherein,

said spacing element has a lower surface with a saddle-shape including a convex central section and two substantially flat surfaces on each side thereof, and

the upper surface of said support element has a saddle-shape including a concave central section and two substantially flat surfaces on each side thereof providing a complimentary fit which serves to prevent relative rotation between the support element and the spacing element.

13. The construction spacer of Claim 9 wherein said removable spacing element is color-coded according to its vertical height.

14. A method of forming high-strength reinforced concrete having elongated reinforcing members formed therein, including the steps of:

(a) providing a plurality of spaced construction spacers, each including,

a support element for providing stable support of a portion of at least one reinforcing member upon a supporting surface,

a removable spacing element positionable upon an upper surface of said support element, including means for securely supporting said spacing element on said upper surface, and

a unitary removable clamp member capable of securing an upper reinforcing member along a first axis and a lower reinforcing member along a second axis substantially perpendicular to said first axis, said clamp member having a pair of extending leg members at one end thereof, each leg member securable within contiguous slots formed within said support element and said spacing element and in a plane substantially perpendicular to said first and second axes, said leg members being sufficiently spaced apart to allow said lower reenforcing member to be received therebetween along said second axis, said clamp member terminating at a second end which is hooked for receiving said upper reinforcing

member along said first axis, said spacing elements having various vertical heights;

(b) positioning said construction spacers in a desired geometric height pattern, the appropriately sized spacing elements required to form said geometric pattern being secured within respective spaced support elements, and the reinforcing members being secured by said clamp members; and

(c) pouring concrete around said construction spacers and reinforcing members and allowing the concrete to cure.

15. The method of Claim 14 further including the step of placing said reinforcing members in tension after the concrete is poured and cured for increasing the strength of the reinforced concrete, the desired geometric height pattern being maintained throughout the strengthening process.

16. The method of Claim 15 wherein the step of positioning said construction spacers includes the positioning in a generally sinusoidal vertical height pattern.

17. The method of Claim 14 wherein the step of providing a plurality of construction spacers includes providing spacing elements being color coded according to their vertical heights so as to provide a visual determination as to whether the proper geometric pattern is maintained.

18. The method of Claim 14 wherein the spacing elements being provided each have an upper surface with a saddle-shape including a concave central section for supporting said lower reinforcing member, and two substantially flat surfaces on each side thereof having said slot formed therethrough.

INTERNATIONAL SEARCH REPORT

International Application No. PCT/US 89/03456

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC.

IPC (4): E04C 5/16
U.S. Cl.: 52/685, 687, 689; 248/74.4

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
U.S	52/677-689,719; 248/74.1,74.3,74.4,221.4,505

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
X,P	US, A, 4,835,933 (YUNG) 06 June 1989, see the entire document.	1-18
A	US, A, 1,921,538 (PRIEST) 08 August 1933, see page 1, lines 66-92.	1-18
A	US, A; 3,447,277 (KORF) 03 June 1969. see column 2, lines 7-16.	1,9,14
A	US, A, 3,694,989 (OLIVER ET AL.) 03 October 1972, see column 2, lines 20-24.	1,9,14
A	US, A, 4,060,954 (LIUZZA) 06 December 1977, see column 1, lines 23-43.	1,9,14
A	US, A, 4,655,023 (YUNG) 07 April 1987, see column 5, lines 3-22.	1,9,14
A	GB, A, 1,017,148 (HUFNAGL) 19 January 1966, see page 4, lines 83-118	1,8,9,13,14
A	DE, B, 1,285,709 (BETONWERK WERNAN G.M.B.H.) 19 December 1968, see Figure 3.	1,9,14
A	CH, A, 470,555 (FORROTEST G.M.B.H) 14 May 1969, see Figure 7.	1,9,14
A	DE, A, 2,532,933 (VALLALAT) 12 February 1976, see Figures 1 and 2.	1,9,14

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
27 October 1989	15 DEC 1989
International Searching Authority	Signature of Authorized Officer

Fig. 1

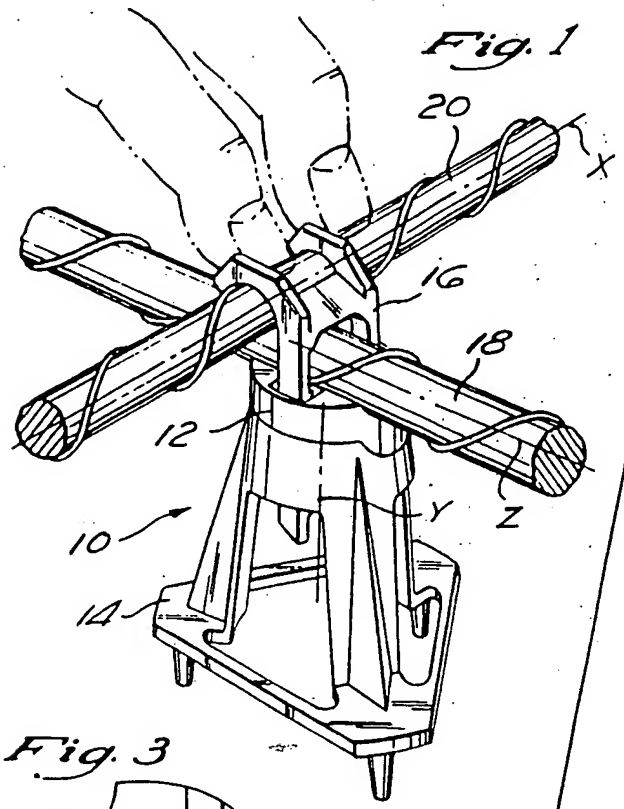


Fig. 2

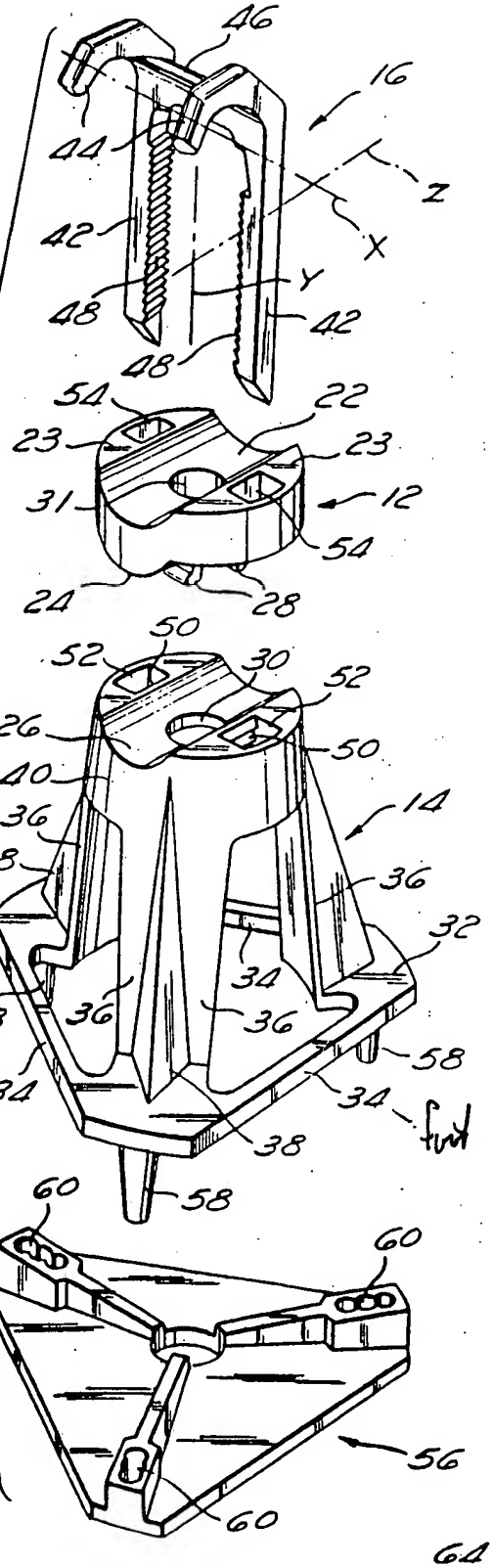


Fig. 3

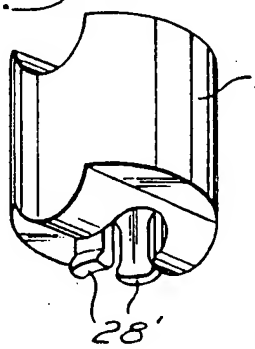


Fig. 5

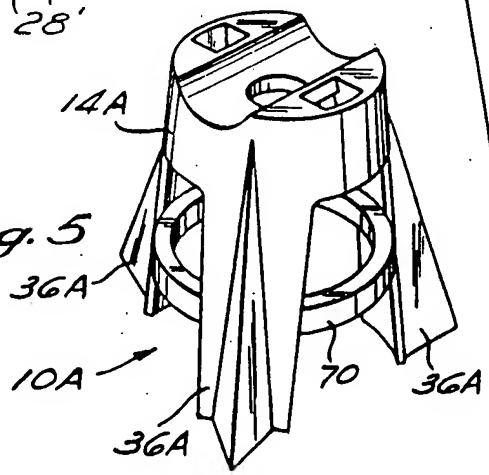


Fig. 4